Number Properties and Operations Students should enter high school with a strong background in rational numbers and numerical operations and expand this to real numbers. This becomes the foundation for algebra and working with algebraic symbols. They understand large and small numbers and their representations, powers and roots. They compare and contrast properties of numbers and number systems and develop strategies to estimate the results of operations on real numbers.
High School
Number Sense
MA-H11-1.1.1a *Students will use order relations (less than, greater than, equal to) to represent problems using real numbers.*
MA-H11-1.1.1b *Students will demonstrate the relationships between different subsets of the real number system.*
MA-H11-1.1.1c *Students will use scientific notation to express very large or very small quantities.*
Estimation
MA-H11-1.2.1a *Students will estimate solutions to problems with real numbers (including very large and very small quantities) in both real world and mathematical situations, and use the estimations to check for reasonable computational results.*

Number Operations
MA-H11-1.3.1 **Students will simplify real number expressions in mathematical problems (including addition, subtraction, multiplication, division, absolute value, integer exponents, roots [square, cube], factorials), and will use these expressions to solve real-world problems to a specified accuracy.**
MA-H11-1.3.2 **Students will recognize, describe, or extend arithmetic and geometric sequences; will determine a specific term of a sequence given an explicit formula; will write an explicit rule for the nth term of an arithmetic sequence; and will use sequences to solve real-world and/or mathematical problems.** *MA-H11-1.3.2a* *Students will write an explicit rule for the nth term of a geometric sequence.*
Ratios and Proportional Reasoning
MA-H11-1.4.1 **Students will use ratios and proportions to solve real-world and/or mathematical problems, such as those involving slope and rate, and will explain how slope shows a rate of change in linear functions representing real-world problems.**
Properties of Numbers and Operations
MA-H11-1.5.1 **Students will explain how real number properties such as commutative, associative, distributive, and identity are used to justify a given step in a problem.** *MA-H11-1.5.1a* *Students will use equivalence relations (reflexive, symmetric, transitive) to solve problems using real numbers.*

Measurement Students continue to measure and estimate measurements including fractions and decimals. They use formulas to find perimeter, area, circumference and volume. They use rulers and protractors. They use US Customary and metric units of measurement.
High School
Measuring Physical Attributes
MA-H11-2.1.1 **Students will find, when given the formulas, the surface area and volume of rectangular prisms, pyramids, cylinders, cones, and spheres in real-world and/or mathematical situations.**
MA-H11-2.1.2 **Students will describe how a change in one or more dimensions of a geometric shape affects the perimeter, area, and volume of the shape.**
MA-H11-2.1.3 **Students will use definitions and properties of right triangle relationships (right triangle trigonometry and the Pythagorean theorem) to determine length and angle measures to solve real-world and/or mathematical problems.**
Systems of Measurements
MA-H11-2.2.1a *Students will continue to apply to both real world and mathematical situations U.S. customary and metric systems of measurement.*

Geometry Middle grade students expand analysis of two-dimensional shapes and three-dimensional shapes. They translate shapes in a coordinate plane. They extend work with congruent and similar figures, including proportionality. They use Pythagorean theorem.
High School
Shapes and Relationships
MA-H11-3.1.1 **Students will describe, analyze, and apply spatial relationships (not using Cartesian coordinates) among points, lines, and planes (e.g., betweenness of points, midpoint, segment length, collinear, coplanar, parallel, perpendicular, skew).**
MA-H11-3.1.2 **Students will describe, analyze, and apply angle relationships (e.g., linear pairs, vertical, complementary, supplementary, corresponding, and alternate interior angles) in real-world and/or mathematical situations.**
MA-H11-3.1.3 **Students will classify and apply properties of two-dimensional geometric figures (e.g., number of sides, vertices, length of sides, sum of interior and exterior angle measures).**
MA-H11-3.1.4 **Students will use properties of triangles (e.g., Triangle Sum theorem and Isosceles Triangle theorems) to solve problems in real-world and/or mathematical situations.**
MA-H11-3.1.5 **Students will classify and apply properties of three-dimensional geometric figures (e.g., number of edges, faces, vertices).** *MA-H11-3.1.1a* *Students will describe the intersection of a plane with a three-dimensional figure*
MA-H11-3.1.6 **Students will apply the concepts of congruence and similarity to solve real-world and/or mathematical problems (not including proofs).**
Transformations of Shapes
MA-H11-3.2.1 **Students will describe properties, and apply geometric transformations (with and without a coordinate plane) to real-world and/or mathematical situations.**
Coordinate Geometry
MA-H11-3.3.1 **Students will use algebra and the coordinate plane to analyze and solve problems (e.g., finding the final coordinates for a specified polygon, finding midpoints, finding the diustance between two points, finding the slope of a segment).**

Data Analysis and Probability School students extend data representations, interpretations and conclusions. They describe data distributions in multiple ways and connect data gathering issues with data interpretation issues. They relate curve of best fit with two-variable data and determine line of best fit for a given set of data. They distinguish between combinations and permutations and compare and contrast theoretical and experimental probability.
High School
Data Representations
MA-H11-4.1.1 **Students will read/interpret, analyze, and make inferences from a set of data with no more than two variables, and will analyze situations for the use and misuse of data representations.**
MA-H11-4.1.2 **Students will organize and construct data displays for data with no more than two variables.**
MA-H11-4.1.3a *Students will represent real-world data using matrices and will use matrix addition, subtraction, multiplication (with matrices no larger than 2x2), and scalar multiplication to solve real-world problems.*
Characteristics of Data Sets
MA-H11-4.2.1 **Students will use shapes of graphs, measures of center (mean, median, mode), and measures of spread (range, standard deviation) to describe data distributions and to draw conclusions.**
MA-H11-4.2.2 **Students will recognize and select the appropriate curve of best fit (linear, quadratic, exponential) for a set of two-variable data and will determine a line-of-best-fit equation and will use that equation to predict within and beyond a given set of data.**
Experiments and Samples
MA-H11-4.3.1 **Students will explain how data gathering (e.g., polling only a specific group of people, using limited or extremely small sample sizes, bias issues) can lead to inaccurate inferences.**

Probability
MA-H11-4.4.1 **Students will determine theoretical and experimental (from given data) probabilities, will make predictions and draw inferences from probabilities, will contrast and compare theoretical and experimental probabilities, and will calculate probabilities involving replacement and non-replacement.** *MA-H11-4.4.1a* *Students will recognize or identify the differences between combinations and permutations and use them to count discrete quantities.* *MA-H11-4.4.1b* *Students will represent probabilities in multiple ways, such as fractions, decimals, percentages, and geometric area models.*

Algebraic Thinking
High school students extend analysis and use of functions and focus on linear, quadratic, absolute value and exponential functions. They explore parametric changes on graphs of functions. They use rules and properties to simplify algebraic expressions. They combine simple rational expressions and combine simple polynomial expressions. They factor polynomial expressions and quadratics of the form 1x^2 + bx +c.

High School

Patterns, Relations, and Functions

MA-H11-5.1.1
Students will use multiple representations (tables, graphs, equations) of functions (linear, quadratic, absolute value, exponential) to solve real-world and/or mathematical problems.

MA-H11-5.2.1a
Students will identify, relate, and apply representations (graphs, equations, tables) of a piecewise function (such as long distance telephone rates) from mathematical or real world information.

MA-H11-5.2.1b
Students will demonstrate how equations and graphs are models of the relationship between two real world quantities (e.g., the relationship between degrees Celsius and degrees Fahrenheit)

MA-H11-5.1.2
Students will:

- **Recognize an example of a function;**
- **Identify the role of independent and dependent variables in a function;**
- **Determine the domain and range of a function (linear and quadratic);**
- **Find the slope and intercepts of a linear function;**
- **Find the maximum, minimum, and intercepts of a quadratic function; and**
- **Use function notation to evaluate a function for a specified integer value.**

MA-H11-5.1.1a
Students will find the domain and range for absolute value functions.

MA-H11-5.1.1b
Students will apply and use direct and inverse variation to solve real world and mathematical problems.

MA-H11-5.1.3
Students will explain how changes in parameters affect graphs of functions (e.g., compare $y=x^2$, $y=2x^2$, $y=(x-4)^2$, and $y=x^2+3$).

Variables, Expressions, and Operations
MA-H11-5.2.1 **Students will use order of operations, real number properties (identity, inverse, commutative, associative, distributive, closure), and rules of exponents (integer) to simplify algebraic expressions.**
MA-H11-5.2.2 **Students will add, subtract, and multiply polynomial expressions; will factor polynomial expressions using the greatest common monomial factor; and will factor quadratic polynomials of the form ax^2+bx+c, when a=1 b and c are integers.** *MA-H11-5.3.3a* *Students will factor quadratic polynomials, such as perfect square trinomials and quadratic polynomials of the form $ax^2 + bx + c$ when a≠1 and band c are integers.*
MA-H11-5.2.3 **Students will add, subtract, multiply, and divide simple rational expressions with monomial first-degree denominators and whole number numerators (e.g., $\frac{1}{x}+\frac{2}{y}$; $\frac{1}{x}-\frac{1}{y}$; $\frac{1}{x}\times\frac{1}{y}$; $\frac{1}{x}\div\frac{1}{y}$**

Equations and Inequalities
MA-H11-5.3.1 **Students will write first degree, single variable equations and inequalities; will use them to solve real-world and/or mathematical problems; and will graph the solutions on a number line.** *MA-H11-5.3.1a* *Students will solve absolute value equations.* *MA-H11-5.3.1b* *Students will solve for a specified variable in a multivariable equation.*
MA-H11-5.3.2 **Students will write first degree, two-variable equations and inequalities; will use them to solve real-world and/or mathematical situations; and will graphs the solutions on a coordinate plane.**
MA-H11-5.3.3 **Students will write and graph systems of linear equations (two equations in two variables), use the system to solve and interpret real-world and/or mathematical problems.** *MA-H11-5.3.3a* *Students will write, graph, and solve systems of linear inequalities (two inequalities in two variables) based on real world or mathematical situations and interpret the solution.*
MA-H11-5.3.4 **Students will solve quadratic equations from real world or mathematical situations.**